

ERRATUM
March 1, 2007

Comprehensive Round 2 Report
Appendix G – Ecological Risk Assessment (ERA)
Portland Harbor RI/FS
February 21, 2007

1. **Appendix G, Figure 3-4:** Figure 3-4 revised on 2/28/07 (attached) should replace Figure 3-4 submitted on 2/21/07. Figure has been updated to accurately reflect Transition Zone Water (TZW) Framework process that was conducted in the ERA of the Comprehensive Round 2 Report.
2. **Appendix G, pages 39-41 (Section 3.5.1.1. through Section 3.5.1.2.3):** Pages 39 through 41 revised on 2/28/07 (attached) should replace pages 39 through 41 submitted on 2/21/07. Text has been updated to accurately reflect the TZW Framework process that was conducted in the ERA of the Comprehensive Round 2 Report.

3.5.1.1 Transition Zone Water Evaluation Framework

A TZW framework was developed to identify potential iCOCs in TZW for ecological receptors (Figure 3-4). All data collected in the biologically active zone (≤ 38 cm) were included in assessment of TZW, including unfiltered and filtered Trident, peepers, and unfiltered Geoprobe[®] data. In addition, offshore groundwater sampling was performed by Siltronic in May and June of 2005 using the Geoprobe[®] sampling method, and those data were evaluated in the TZW framework.

3.5.1.1.1 Development of Ecological Screening Levels

Eco SLs were used both in the screening assessment (Attachment G3) and in the TZW assessment for benthic invertebrates to evaluate potential risks. Eco SLs were developed through a review of water quality benchmarks and literature-based thresholds (Attachment G3). Eco SLs were developed for all TZW COIs except individual dioxins and furans, because no data were available for the individual dioxin and furan COIs in TZW.

For metals, Eco SLs were hardness adjusted, when appropriate. The toxicity of some metals depends upon the hardness of the water. Filtered TZW samples had measured average hardness equivalent to 478 mg/L CaCO₃, a median of 238 mg/L CaCO₃, and a maximum of 3,357 mg/L CaCO₃ based on 93 samples. The Eco SLs for hardness-dependent metals were modified using the following EPA National Recommended Water Quality Criteria (EPA 2006) formula for hardness:

$$\text{CCC (dissolved)} = \exp\{m_c [\ln(\text{hardness})] + b_c\} \quad \text{Equation 3-1}$$

Where:

- CCC = criterion continuous concentration (an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect)
- m_c = constant that varies by metal
- b_c = constant that varies by metal

Eco SLs for metals were also adjusted, if the criteria were developed using dissolved concentrations, and then compared to dissolved concentrations, when appropriate.

3.5.1.1.2 Determination of Groundwater Sources

In the TZW framework, groundwater sources of Round 2 COPCs were determined by assessment of potential groundwater pathways from upland groundwater plumes to the transition zone within the Study Area. Comparisons between chemicals produced and chemicals found in TZW samples were used to determine if complete pathways for groundwater sources were evident (Integral 2006). Integrated analyses of discharge and sampling results, seepage meter results, Trident probe temperature measurements, sediment texture, stratigraphic information, and TZW chemistry in conjunction with available site data were also used to determine if a complete groundwater pathway was apparent (Integral 2006).

Nine properties were evaluated for evidence of complete pathways for transport of upland groundwater contaminants to the transition zone (Figure 3-5). Two distinct sections were analyzed at the Arkema site because the property contained an acid plant and a chlorate plant in separate locations with potentially different groundwater characteristics (Integral 2006). The nine properties are identified as:

- Arco Terminal 22T
- Arkema (acid plant and chlorate plant)
- ExxonMobil Oil terminal
- Gasco
- Gunderson
- Kinder Morgan Linnton Terminal
- Rhône-Poulenc
- Siltronic
- Willbridge bulk fuels terminals

If a complete groundwater pathway was verified in the Portland Harbor RI/FS, the Round 2 COPCs associated with the source were carried forward for in the TZW framework in the additional Round 2 COPC evaluation (Section 3.5.1.1.4). Metals not attributed to groundwater contamination were first evaluated by comparing sediment concentrations to upstream sediment concentrations (Section 3.5.1.1.3), before being carried forward into the additional Round 2 evaluation (Section 3.5.1.1.4).

3.5.1.1.3 Evaluation of Metals

The metals identified as Round 2 COPCs with an incomplete groundwater pathway were evaluated in the TZW framework by comparing upstream sediment concentrations (for those Round 2 COPCs where upstream data were available) to Study Area sediment concentrations. If the maximum metal concentration did not the upstream sediment concentration, the metal Round 2 COPC was not retained for further analysis.

3.5.1.1.4 Additional Round 2 COPC Evaluation

Round 2 COPCs were also evaluated in the TZW framework, based on additional information, including: 1) a spatial evaluation of TZW concentration exceedances of Eco SLs and an evaluation of metal Round 2 COPC sediment concentration trends across the Study Area (by river mile), 2) an evaluation of the magnitude of TZW exceedances of Eco SLs, and 3) an evaluation of the how the dilution factor between TZW and near-bottom surface water data and porewater ventilation would effect the benthic invertebrate exposure concentration of Round 2 COPCs.

3.5.1.2 Results of the TZW Framework Evaluation

Round 2 COPCs were further evaluated using the TZW framework to identify potential iCOCs in TZW (Table 3-25). The results of this evaluation are presented in the following subsections.

3.5.1.2.1 Round 2 COPC Groundwater Source Evaluation

Complete groundwater pathways were identified at the Arkema and Siltronic properties. A potential groundwater source was identified at the Rhône-Poulenc property, and an indeterminate pathway was identified at the Gasco property. No definitive groundwater pathways were established at ARCO, ExxonMobil Oil, Gunderson, Kinder Morgan Linnton, or Willbridge (Integral 2006).

3.5.1.2.2 Round 2 COPC Metals Comparison to Upstream Data

Based on the comparison of metals concentration to upstream sediment, no Round 2 COPCs in TZW were eliminated from further analysis. Four Round 2 COPC metals (cadmium, lead, copper, and zinc) were compared to upstream background concentrations in sediment, to evaluate metals Round 2 COPCs in TZW with a potential sediment source. The maximum concentration of each of these metal Round 2 COPCs exceeded upstream concentrations in sediment. The percent exceedance of TZW concentrations of the upstream sediment UCL on 90th percentile threshold level ranged from 36% (cadmium) to 62% (lead) (Table 3-26).

3.5.1.2.3 Additional Round 2 COPC Evaluation

All remaining Round 2 COPCs were further evaluated in the TZW framework by analyzing site-wide trends in TZW and exceedances of Eco SLs across the Study Area. Hazard quotients (HQs) were derived and evaluated to determine the spatial extent of TZW concentrations exceeding Eco SLs. HQs were calculated by dividing the maximum TZW concentration for Round 2 COPCs in each TZW sample by the chronic Eco SL. Based on the analysis of spatial extent of TZW concentrations, additional Round 2 COPCs in TZW were eliminated from further analysis.

Metals

Based on the analysis of Study Area-wide trends of TZW concentrations, three metal Round 2 COPCs in TZW (i.e., barium, sodium, and vanadium) were eliminated from further analysis. Sodium and vanadium have elevated sediment concentrations in limited areas of the Study Area. Sodium concentrations in sediment spike between RM 7.05 and RM 7.56. Vanadium concentrations in TZW exceeded Eco SLs at the Siltronic site, and concentrations in sediment samples exhibited a corresponding increase in the vicinity of the same site. The limited spatial extent of elevated sodium and vanadium concentrations reduces their relevance as population-level stressors. Barium concentrations in sediment were consistent across river miles. Because of the ubiquitous presence of this metal in sediment, barium concentrations in TZW are considered representative of the anthropogenic background level in an urban area. Therefore, barium, sodium, and vanadium were not carried forward as potential iCOCs for TZW.

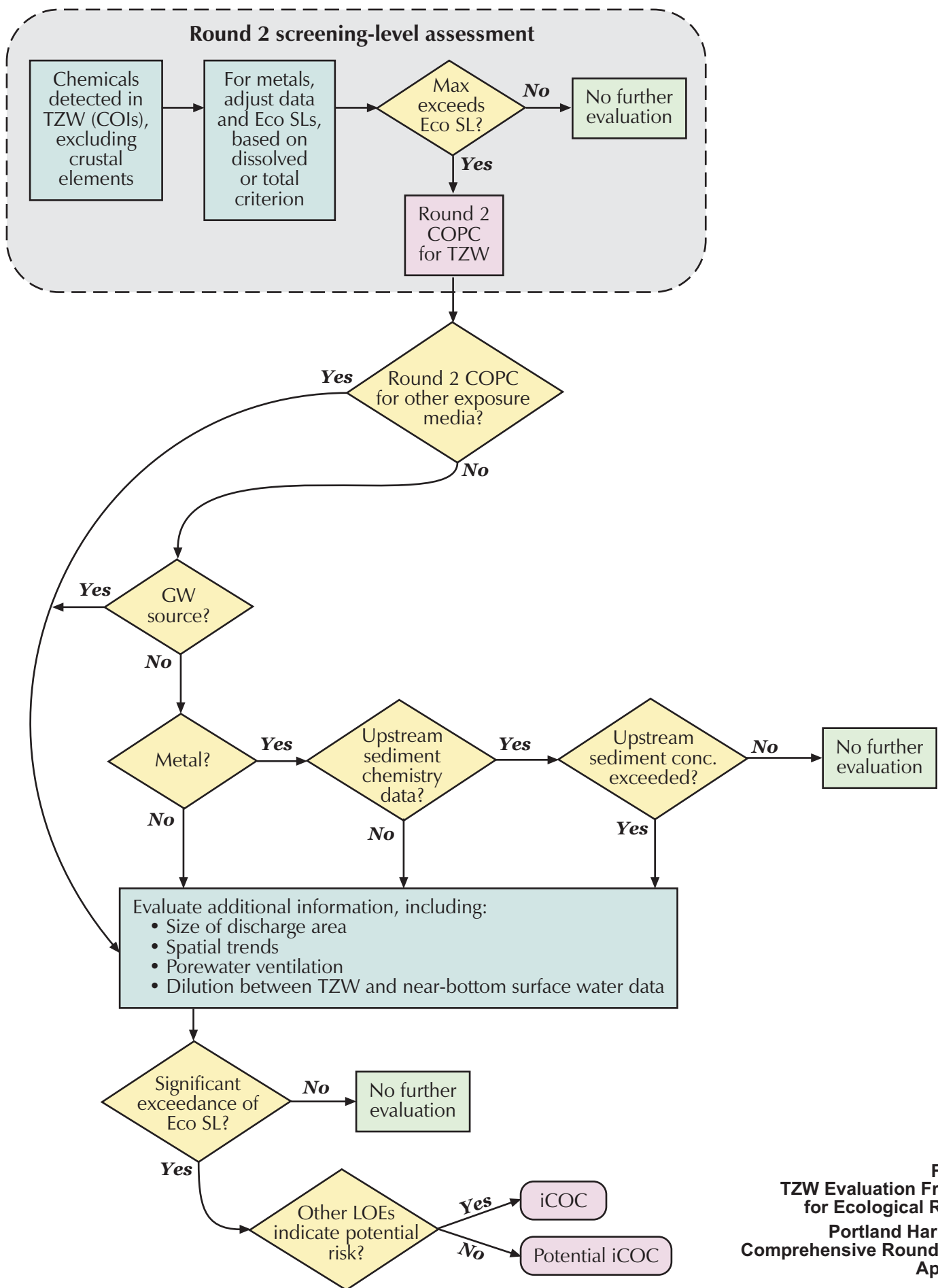


Figure 3-4
TZW Evaluation Framework
for Ecological Receptors
Portland Harbor RI/FS
Comprehensive Round 2 Report
Appendix G